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10/538,534	06/10/2005	Wayne D. Frasch	112624.00089	4137

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EXAMINER	
SHAW, AMANDA MARIE	
ART UNIT	**PAPER NUMBER**
1634	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/538,534	Applicant(s) FRASCH ET AL.	
	Examiner Amanda M. Shaw	Art Unit 1634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 08 January 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 40-59 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 40-59 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____is/ are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 8, 2008 has been entered.

Claims 40-59 are currently pending. Claims 40-59 are newly presented. Claims 40-59 have been addressed herein.

Withdrawn Objections

2. The objections made in the second paragraph of the Office Action of July 20, 2007 are moot in view of the cancellation of all previously pending claims.

Withdrawn Rejections

3. The rejections made under 35 USC 103(a) in the paragraphs six and seven of the Office Action of July 20, 2007 are moot in view of the cancellation of all previously pending claims.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 40-45 and 47-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002) as evidenced by Mock (Nano Letters Pub 4/2002) and in further view of Pettingell et al (US Patent 6449088 Filed 1993).

Regarding Claims 40-45 Yasuda teaches a molecular structure having a rotating arm, wherein the molecular structure is an F1-ATPase enzyme (Abstract). Yasuda further teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of the molecular structure so that the nanoparticle rotates with the rotating arm of the

molecular structure (See Fig 1). Yasuda further teaches that bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light.

Yasuda does not teach a method wherein the nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Yasuda does not teach that the first surface of the nanoparticle scatters a first polarized wavelength of the light when the nanoparticle is in a first position and the second surface of the nanoparticle scatters a second polarized wavelength of light when the nanoparticle is in a second position. Further Yasuda does not teach a method wherein the nanoparticle is a gold nanorod. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light. Finally Yasuda does not teach a method wherein the first polarized wavelength of light is red light and the second polarized wavelength of the light is green light.

However Sonnichsen teaches gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen further describes the typical single particle scattering spectra from a nanorod. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the rod axis and that the short axis resonance spectra

can be examined by using excitation light polarized along the short axis (page 2, col 2). Thus Sonnichsen teaches a nanoparticle having at least two surfaces wherein the first surface scatters a first polarized wavelength of the light when the nanoparticle is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and the second surface of the nanoparticle scatters a second polarized wavelength of light when the nanoparticle is in a second position relative to the light source (i.e., when the light is polarized along the short axis). Further it is an inherent property that when light is polarized along the long axis of a gold nanorod it produces red light which has a longer wavelength) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a shorter wavelength). This is evidenced by the teachings of Mock (See Fig 3).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold nanorod as suggested by Sonnichsen. In the instant case, gold nanorods make it possible to observe a rotational motion because gold nanorods have two different surface plasmon resonances which makes it possible to observe alternating first and second wavelengths of light as the nanoparticles move from a first position (i.e. where the light is polarized along the long axis) to a second position (i.e. where the light is polarized along the short axis). Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies

and large local field enhancement factors, making nanorods interesting for a range of optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

Additionally it is noted that the combined teachings of Yasuda and Sonnichsen do not teach a step of filtering the first and second wavelengths of light through a polarizing filter.

However Pettingell discloses using polarizing microscopes which use polarizers to look at anisotropic materials (e.g., materials that have a first and second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the first and second wavelengths of light generated by anisotropic materials.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda and Sonnichsen by using the polarizer of Pettingell. Polarizers were well known in the art at the time of the invention for looking at anisotropic materials as demonstrated by Pettingell. In the instant case all of the claimed elements were known in the prior art and one skilled in the art could have combined the elements, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Regarding Claims 47-52 Yasuda teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of an F1-ATPase enzyme so that the nanoparticle rotates with the rotating arm of the F1-ATPase enzyme (See Fig 1). Yasuda further teaches that bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light.

Yasuda does not teach a method wherein the nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Yasuda does not teach exposing light to a first surface of the nanoparticle to scatter a first polarized wavelength of the light and exposing light to a second surface of the nanoparticle to scatter a second polarized wavelength of light. Further Yasuda does not teach a method wherein the nanoparticle is a gold nanorod. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light.

However Sonnichsen teaches gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen further describes the typical single particle scattering spectra from a nanorod. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the rod axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2).

Thus Sonnichsen teaches a nanoparticle having at least two surfaces wherein the first surface scatters a first polarized wavelength of the light when the nanoparticle is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and the second surface of the nanoparticle scatters a second polarized wavelength of light when the nanoparticle is in a second position relative to the light source (i.e., when the light is polarized along the short axis). Further it is an inherent property that when light is polarized along the long axis of a gold nanorod it produces red light which has a longer wavelength) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a shorter wavelength). This is evidenced by the teachings of Mock (See Fig 3).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold nanorod as suggested by Sonnichsen. In the instant case, gold nanorods make it possible to observe a rotational motion because gold nanorods have two different surface plasmon resonances which makes it possible to observe alternating first and second wavelengths of light as the nanoparticles move from a first position (i.e. where the light is polarized along the long axis) to a second position (i.e. where the light is polarized along the short axis). Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of

optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

Additionally it is noted that the combined teachings of Yasuda and Sonnichsen do not teach a step of filtering the first and second wavelengths of light through a polarizing filter.

However Pettingell discloses using polarizing microscopes which use polarizers to look at anisotropic materials (e.g., materials that have a first and second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the first and second wavelengths of light generated by anisotropic materials.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda and Sonnichsen by using the polarizer of Pettingell. Polarizers were well known in the art at the time of the invention for looking at anisotropic materials as demonstrated by Pettingell. In the instant case all of the claimed elements were known in the prior art and one skilled in the art could have combined the elements, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

6. Claims 54-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002) as evidenced by Mock (Nano Letters Pub 4/2002).

Regarding Claims 54-59 Yasuda teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of an F1-ATPase enzyme so that the nanoparticle rotates with the rotating arm of the F1-ATPase enzyme (See Fig 1). Yasuda further teaches that bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light.

Yasuda does not teach a method wherein an anisotropic nanoparticle is used. Yasuda does not teach exposing light to the anisotropic nanoparticle to scatter first polarized and second polarized wavelengths of the light. Further Yasuda does not teach a method wherein the anisotropic nanoparticle is a gold nanorod. Yasuda does not teach that the anisotropic nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light.

However Sonnichsen teaches gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen further describes the typical single particle scattering spectra from a

nanorod. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the rod axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2). Thus Sonnichsen teaches a nanoparticle having at least two surfaces wherein the first surface scatters a first polarized wavelength of the light when the nanoparticle is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and the second surface of the nanoparticle scatters a second polarized wavelength of light when the nanoparticle is in a second position relative to the light source (i.e., when the light is polarized along the short axis). Further it is an inherent property that when light is polarized along the long axis of a gold nanorod it produces red light which has a longer wavelength) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a shorter wavelength). This is evidenced by the teachings of Mock (See Fig 3).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold nanorod as suggested by Sonnichsen. In the instant case, gold nanorods make it possible to observe a rotational motion because gold nanorods have two different surface plasmon resonances which makes it possible to observe alternating first and second wavelengths of light as the nanoparticles move from a first position (i.e. where the light is polarized along the long axis) to a second position (i.e. where the light is polarized along the short axis). Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to

nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

7. Claims 46 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002), as evidenced by Mock (Nano Letters Pub 4/2002), and Pettingell et al (US Patent 6449088 Filed 1993) as applied to claims 40 and 47 above and in further view of Felder (US Patent 6232066).

The teachings of Yasuda, Sonnichsen, Mock, and Pettingell are presented above.

The combined references do not teach a method which further includes a step of disposing a detection DNA strand between the nanoparticle and the molecular structure, wherein the detection DNA strand hybridizes with a target DNA strand, if the target DNA strand matches the detection DNA strand, to form a structural link between the molecular structure and the nanoparticle.

However Felder teach an array of probes comprising anchor oligonucleotides immobilized to the substrate and a linker oligonucleotide attached to the anchor oligonucleotides. In the presence of a target nucleic acid, the target binds to the said linker followed by the hybridization of a detector oligonucleotide which has a reporter (Column 1 line 66 to Column 2 line 3 and Figure 1). Thus the linker oligonucleotide and the target nucleotide form a structural link between the anchor and the nanoparticle.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda et al by using a nucleic acid strand to attach the nanoparticle to the molecular structure as suggested by Felder because hybridization methods which use linker oligonucleotides attached to a solid support which bind to target nucleotides attached to detection molecules were routinely performed in the art as demonstrated by Felder. One would be motivated to use nucleic acids rather than streptavidin for the benefit of being able to detect hybridization.

Conclusion

8. No Claims are allowed. Since there are all new grounds of rejection set forth in the Office Action, the applicants remarks are considered moot.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amanda M. Shaw whose telephone number is (571) 272-8668. The examiner can normally be reached on Mon-Fri 7:30 TO 4:30. If

attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ram Shukla can be reached at 571-272-0735. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Amanda M. Shaw
Examiner
Art Unit 1634

JULIET C. SWITZER
PRIMARY EXAMINER